Making the Most of Wood Resources

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Energy Used in Production of Cement, Steel, and Wood

Material	Approximate Global Production	Approximate Per-Ton Production Energy
Portland Cement	5 billion cubic yards	4 million Btu
Steel	1.4 billion metric tons (42% is used in construction)	12 million Btu
Wood	3.9 billion cubic yards	2.7 million Btu (softwood lumber)

Note: These numbers are for raw materials only, not construction products. Actual products like concrete and lumber use varying amounts of raw materials and offer different functional characteristics per unit of weight or volume.

Wood and Carbon

Trees remove CO_2 directly from the atmosphere

Wood is approximately 50% carbon.

Carbon in wood returns to the atmosphere through decomposition and burning.

Using wood in buildings provides a temporary carbon sink

Using wood as fuel is less desirable

Making the Most of Wood Resources

Wood as Fuel

Wood can be a reasonable fuel source

Wood is

- Locally sourced
- Renewable
- Replaces fossil fuels
- Resilient—a good back-up heating option

Wood works best as fuel if

- Taken from residual biomass that would have gone to “waste” otherwise
- Used for both heat and power

Photo: Steve Paluch

But…. .

Burning wood releases

- Fine particulates that are lung irritants and asthmagens
- Sulfur, carbon, and nitrogen oxides that cause acid rain
- Carcinogens that include polycyclic aromatic hydrocarbons (PAHs), benzene, formaldehyde, and dioxin

Steps to minimize pollutants/maximize efficiency

Burn seasoned, dry wood only…not green wood

Burn hot! Don't let fires smolder.

Use more efficient pellet stoves and boilers, when possible

Select properly sized, efficient stoves that meet State of Washington emissions requirements

Photo: USFS

Woodstoves and Boilers

- Woodstoves (residential)
- Pellet stoves (residential)
- Masonry heaters (residential)
- Wood, pellet, and wood chip boilers (residential, commercial, utility scale)

Wood and Pellet stoves

- Old wood stoves, extreme emissions
- New models use dual-chamber combustion and/or catalytic converters
- Pellet stoves produce fewer emission than wood stoves but typically require electricity to run fans and augers; they can be noisy

Wiseway pellet stoves are gravity fed and require no electricity.

Photo: Wiseway

Masonry Heaters

- Old technology common in Europe
- Large built-in fireplaces with multiple internal chambers to extract maximum heat
- Burn hot fires and use the thermal mass of the unit to store and regulate that heat, releasing it slowly over time
- Often custom built, but products and kits are available

Photo: Turtlerock Masonry Heat

Wood and Pellet Boilers

- Thermal storage provides consistent, reliable heat
- Pellet versions are fully automated and operate at very high efficiencies.
- Require electricity for controls, ignition, fans, and augers
- Pellet delivery and storage can be a challenge
- Wood units require more tending/cleaning

Cross-section of HS Tarm Solo Innova that burns cordwood

Photo: Tarm

Wood and Pellet Boilers

Fröling P4 units are available in a variety of outputs for residential or light commercial applications.

Photo: Tarm

District Heating and Combined Heat & Power

Biomass district heating and CHP (cogeneration) plants are more common in Europe but gaining traction in U.S.

CHP plants create steam to generate electricity and heat buildings.

Typically use pellets or wood chips.

Use of wood chips allow municipalities to generate their own fuel

This CHP plant in Växjö, Sweden **provides 29,000 customers with electricity and over 6,500 with heat.**

Photo: Alex Wilson

Montpelier District Heat Plant

Montpelier, Vermont's district heat plant

Making the Most of Wood Resources

Wood as Building Material

Engineered Wood

The Richmond Olympic Oval was the site of speed-skating events during the 2010 Vancouver Olympic Games; its ceiling is made from trees killed by the mountain pine beetle and turned into engineered wood. Photo: BC Living

Engineered Wood—Benefits

Efficient use of wood

Better performance than standard dimensional timber with less waste

When used indoors, it provides a connection to nature

Can replace energy- and CO_2-intensive concrete and steel in many applications

Engineered Wood—Challenges

Cost

Availability

Moisture

Insects

Building codes

Perceptions

Different workflow

Structural Composite Lumber

Laminated veneer lumber (LVL): used for headers and beams, rafters, girders, scaffolds, and more.

Parallel-strand lumber (PSL): uses are similar to LVL, but it can also be used for load-bearing columns.

Oriented-strand lumber (OSL): typically used as rimboard and framing lumber. Not quite as strong or as stiff as LVL.

RedBuilt LVL

Weyerhauser's Parallam

Glulams and I-Joists

Glued laminated timber (glulam): Used for headers, cantilever beams, arches, floor girders, and other interior and exterior structural applications. Can be used as a steel replacement in many applications.

Structurlam Glulam

RedBuilt I-Joists

Wood I-joists, or I-beams: Lighter and stronger than lumber, I-joists are often used structurally in both residential and light commercial construction for floor or roof framing.

Cross-Laminated Timber

Cross-laminated timber (CLT): Used for floors, walls, roofing, and other structural applications, including as a concrete replacement in certain applications.

New Possibilities for Wood

Photo: Martin Tessler

The University of British Columbia's Earth Sciences Building uses glulams in its columns and beams, laminated-strand lumber in its floor panels, and cross-laminated timber for its roof and canopies.

New Possibilities for Wood

Photo: CREE Buildings Inc.

CREE's LCT ONE uses a hybrid system that incorporates glulams and concrete into the floor and wood walls that are pre-assembled in their factory and then assembled onsite.

Questions?